

NASA Ames Research Center, Computational
Sciences Division

NETMARK



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National Aeronautics and Space Administration
Ames Research Center
Computational Sciences Division

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Purpose: to control and interoperate with every block in a document, email, spreadsheet, power point, database, etc. across the lifecycle.

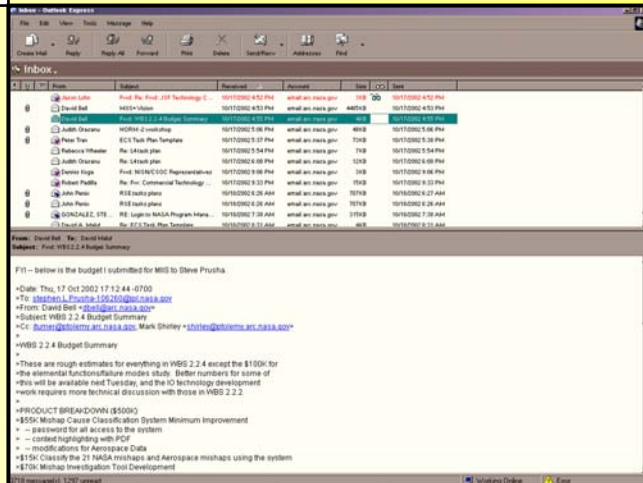
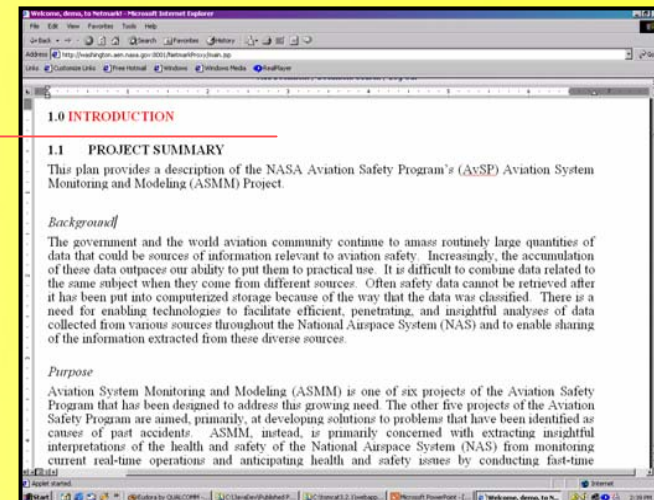
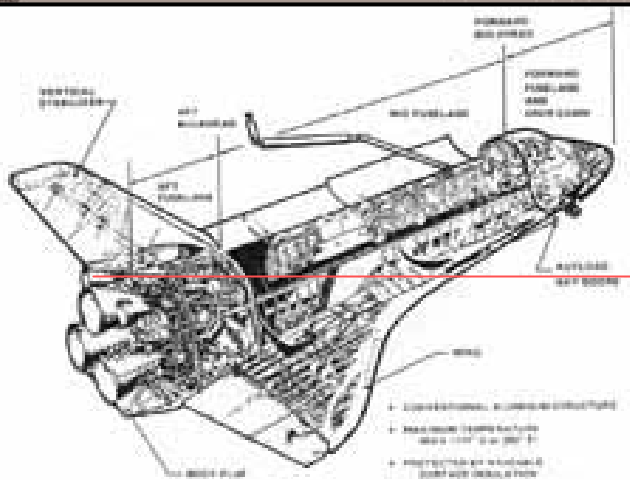
Spread sheet cell

Word document paragraph, title etc.

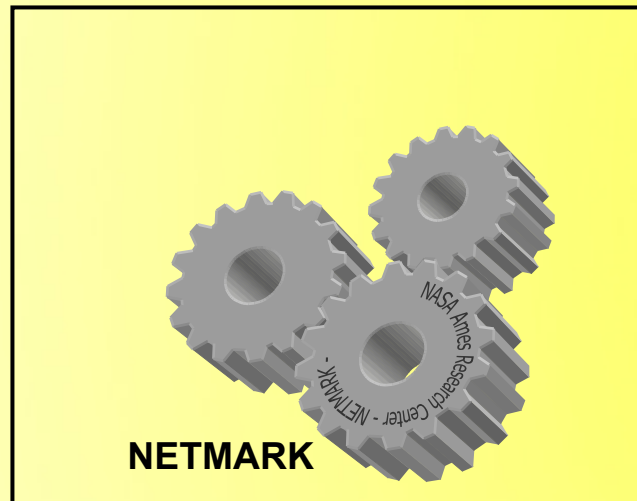
Media and data
Electronic mail paragraph, subjects, headings, etc.

As of Oct 15, 2002

| | | | |
|-------------------------------------------------------------------------------|------|-------------------|-------------------------------------------|
| 1.0 Engineering for Complex System | | | |
| 2.0 System Reasoning Risk Management | | | |
| 2.1 Risk Tools Development & Deployment | JPL | Steve Prosha | stephen.i.prosha@nasa.gov 916-354-5323 |
| 2.1.1 Risk Workstation | JPL | Steven Cornford | steven.cornford@nasa.gov 916-354-1701 |
| 2.1.2 System Complexity Research | ARC | Vagan Turner | turner@arc.nasa.gov 650-604-4940 |
| 2.1.3 Risk-Based Design and Optimization | JPL | Van Hous | vanhous@nasa.gov 916-354-2555 |
| 2.2 Core Risk Research | ARC | Irem Turner | turner@arc.nasa.gov 650-604-4036 |
| 2.2.1 Model Based Hazard-Risk Analysis | ARC | Mark Shirley | shirley@arc.nasa.gov 650-604-3369 |
| 2.2.2 Mapah Investigation Research | ARC | Tina Penland | penland@arc.nasa.gov 650-604-6757 |
| 2.2.3 Risk Characterization and Visualization (RPM) | JPL | Mark S. Feather | feather@nasa.gov 916-354-1194 |
| 2.2.4 MIS: Mapah Initiator Identification System | ARC | David Bell | bell@arc.nasa.gov 650-604-0771 |
| 3.0 Knowledge Engineering for Safe Systems | | | |
| 3.1 Human & Org Risk Management | ARC | Patricia Jones | patricia.jones@arc.nasa.gov 650-604-1345 |
| 3.1.1 Organizational Risk Perception & Mgmt. | ARC | Judith Orsakian | orsakian@arc.nasa.gov 650-604-3404 |
| 3.1.2 Operations Information Analysis | JSC | Steven Gonzalez | steven.gonzalez@arc.nasa.gov 650-604-3404 |
| 3.1.3 Human & Organizational Risk Aspects of Distributed Collaborative Design | JPL | Frederica Wheeler | wheeler@arc.nasa.gov 916-354-1243 |
| 3.2 Engineering Information Management | | | |
| 3.2.1 Lifecycle Systems Integration | ARC | David A. Maluf | maluf@arc.nasa.gov 650-604-0611 |
| 3.2.2 Virtual Non-Test | ARC | Paul Keller | keller@arc.nasa.gov 650-604-6134 |
| 3.2.3 Digital Modeling | KSC | Michael Conroy | conroy@arc.nasa.gov 650-604-6134 |
| 3.2.4 View Integrity Research | ARC | James Costello | costello@arc.nasa.gov 650-604-2551 |
| 4.0 Resilient Systems & Operations | ARC | Juan Palis | palis@arc.nasa.gov 650-604-0332 |
| 4.1 Intelligent & Adaptive Ops & Control | ARC | Juan Palis | palis@arc.nasa.gov 650-604-0332 |
| 4.1.1 Applied Autonomous Aerospace Vehicle Technologies | ARC | Oregon A. Doran | doran@arc.nasa.gov 650-604-4951 |
| 4.1.2 Autonomous Propulsion System Technology | GRC | Sanjay Gang | gang@arc.nasa.gov 216-433-2669 |
| 4.1.3 Adaptive Flight Control Research | DFRC | Jerry Henry | henry@arc.nasa.gov 661-276-3359 |
| 4.1.4 Human Machine Interface | ARC | Richard McQuinn | mcquinn@arc.nasa.gov 650-604-0623 |
| 4.2 Resilient Software Engineering | ARC | John Penik | penik@arc.nasa.gov 650-604-6576 |
| 4.2.1 High Dependability Computing | ARC | Michael Lowry | lowry@arc.nasa.gov 650-604-3369 |



The Mechanics



Load seamlessly into Netmark

Context plus Content search

Regenerate arbitrary
documents from arbitrary
fragments

to some extent ...garbage in, garbage
out.

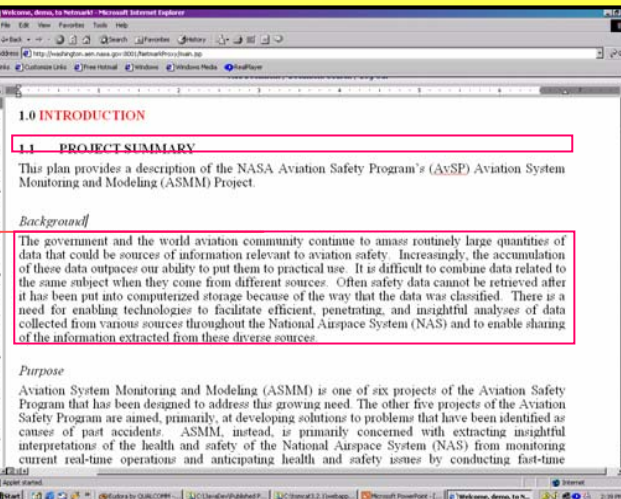
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A fragment in a Spreadsheet is a cell, row, column etc.

Fragments in media data depend on the definitions set within meta data.

Fragments in a word document are headings, paragraphs etc.



A fragment in emails is a heading, paragraph etc.

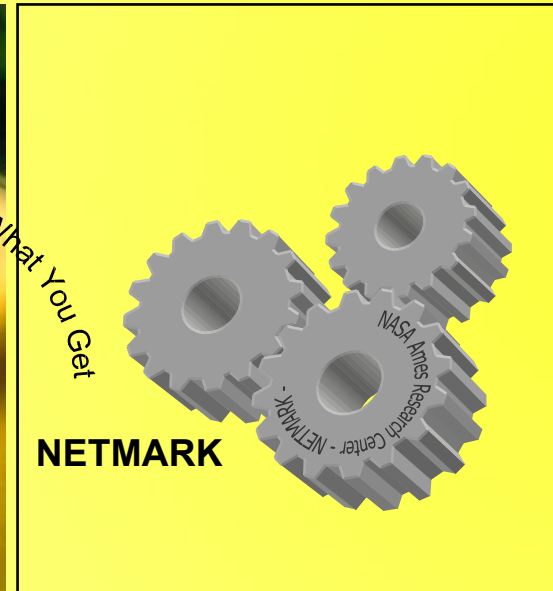
Netmark is a middleware enabling an Enterprise
the **What You See Is What You Get –**
WYSIWYG - for information management.

The Mechanics

Netmark adds a layer in the information
systems paradigm between the documents
and storage. Netmark “**pages**” the
information fragment the way created by
the user-end.

Netmark maintains the relationships
among the fragments of your data the way
created by the user-end.

Netmark provide a fast mechanism to
search on context plus content or
relationship concepts among the
fragments.



Indexed **context**
Indexed content
Fragments linked as in original source

Dynamic Schema-less Definitions

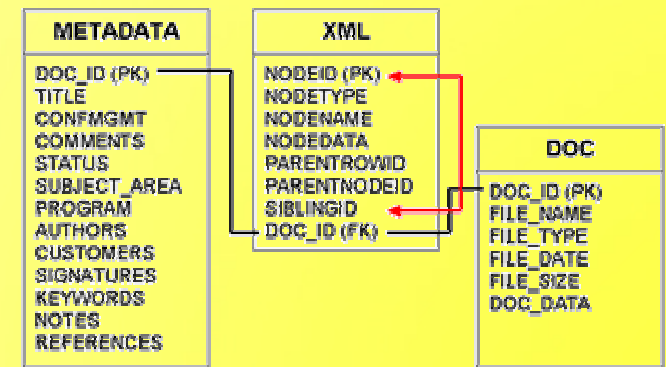


Figure 3: NETMARK Generated Schema

Extensible Architectures

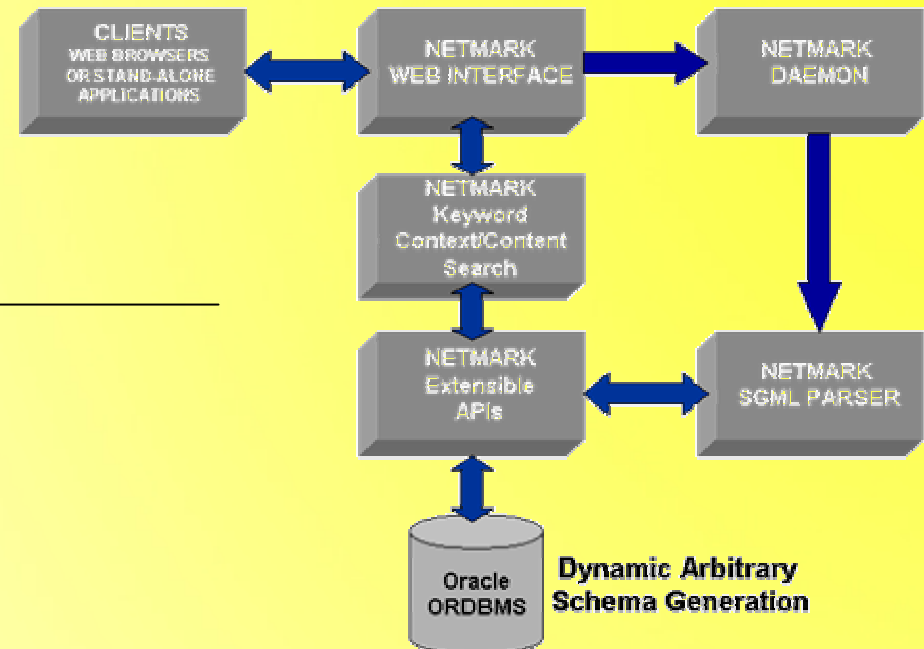


Figure 2: NETMARK Universal Process Flow

Seamless information System

Sources identified:

Non-normalized data: MS
Word documents,
Excel, Adobe PDF, XML,
HTML, Binary, meta-data.
Normalized data: relational
and object oriented.

Interlingua

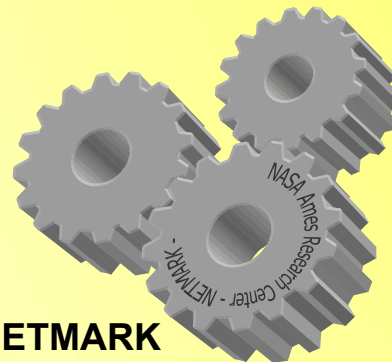
SGML: XML, HTML

Translation:

Microsoft Office,
Adobe, Transliteration,
WordNet (semantic relations)

Mass Storage:

Oracle



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Requirements

OPERATING SYSTEM

Sun Solaris™ 2.6, 2.7 & 2.8

Red Hat Linux 7.0 (*)

JDK SUPPORT

Java 2 (JDK 1.2, 1.3)

C/C++

SYNCHRONIZATION WITH RDBMS

Oracle

Extensible API

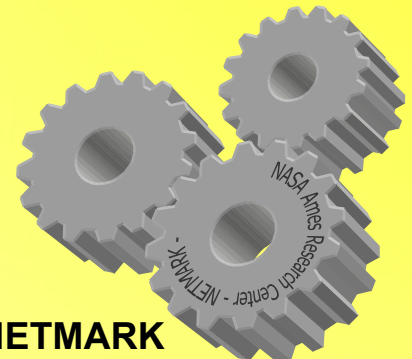
C/C++

Java

PL/SQL

Out of the Box

WebDav,
NFS, FTP, HTTP



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Engineering for Complex Systems
Mishap Report Analysis



Mars Polar Lander accident



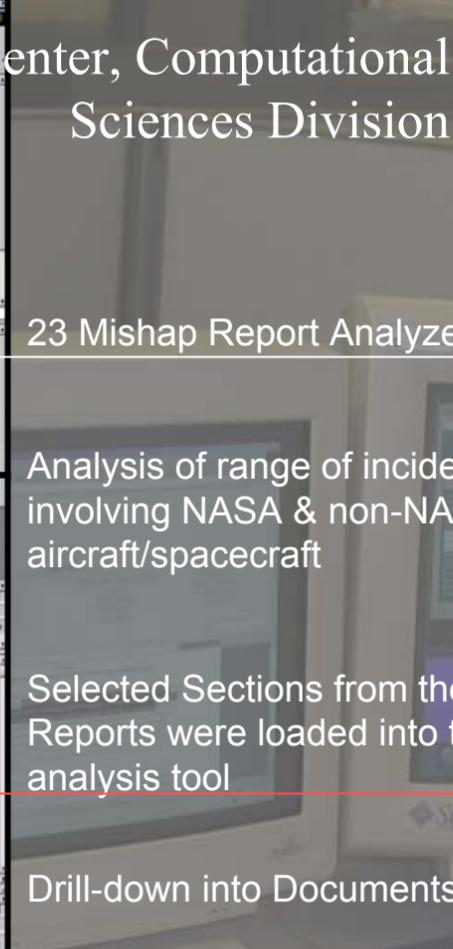
X31 accident



DC-XA accident



Challenger accident



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23 Mishap Report Analyze

Analysis of range of incidents
involving NASA & non-NASA
aircraft/spacecraft

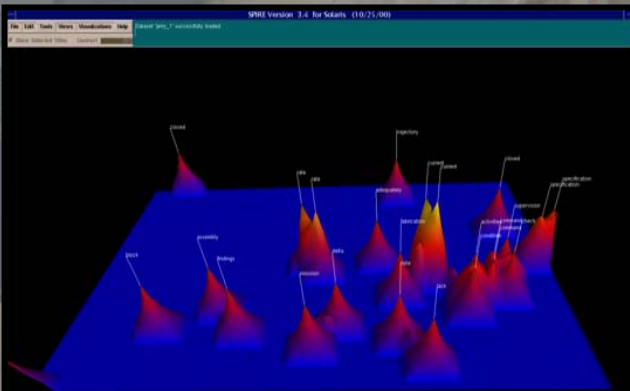
Selected Sections from the
Reports were loaded into the
analysis tool

Drill-down into Documents

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Software development Zero
Setup time/Integration 1FTE, 2 Days

mishap data

[illegible]

Reports distributed across a two-dimensional space based on similarities between reports

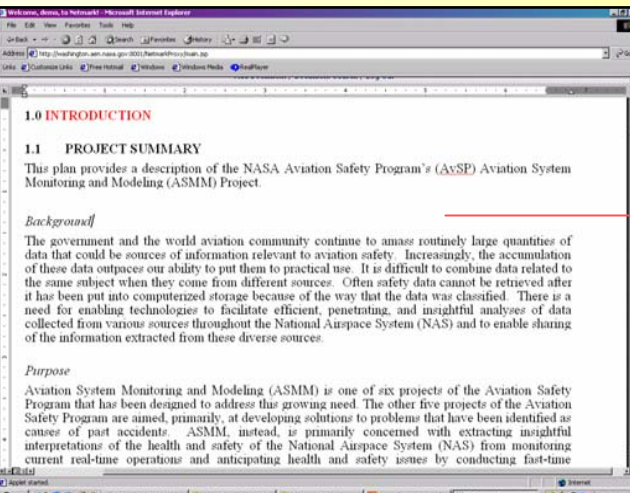
Content-based visualization derived from Galaxies visualization

3D visualization in abstract landscape that represents areas of high thematic content

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Software development Zero
Setup time/Integration 0 FTE, 0 Days



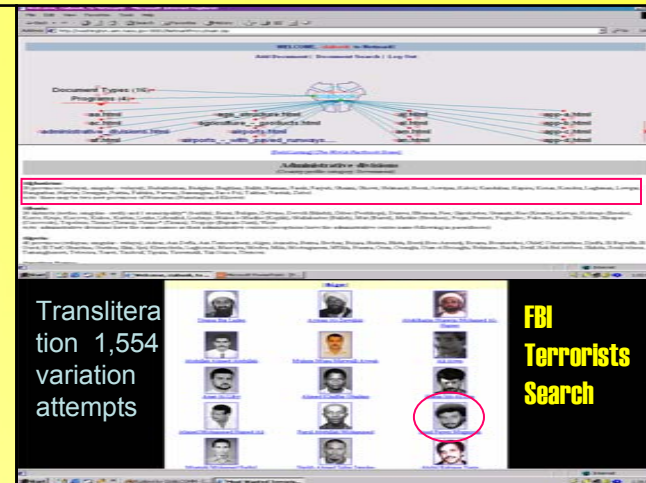
Re-editing: Document construct from disparate documents and fragments, paragraph. Tables, etc.

Search: Meta-Data Directory
Identifying multiple data sources –
5 federal agencies

Integrated Response

highlighting information features

Actual relevant record(s)
Highlighting matches



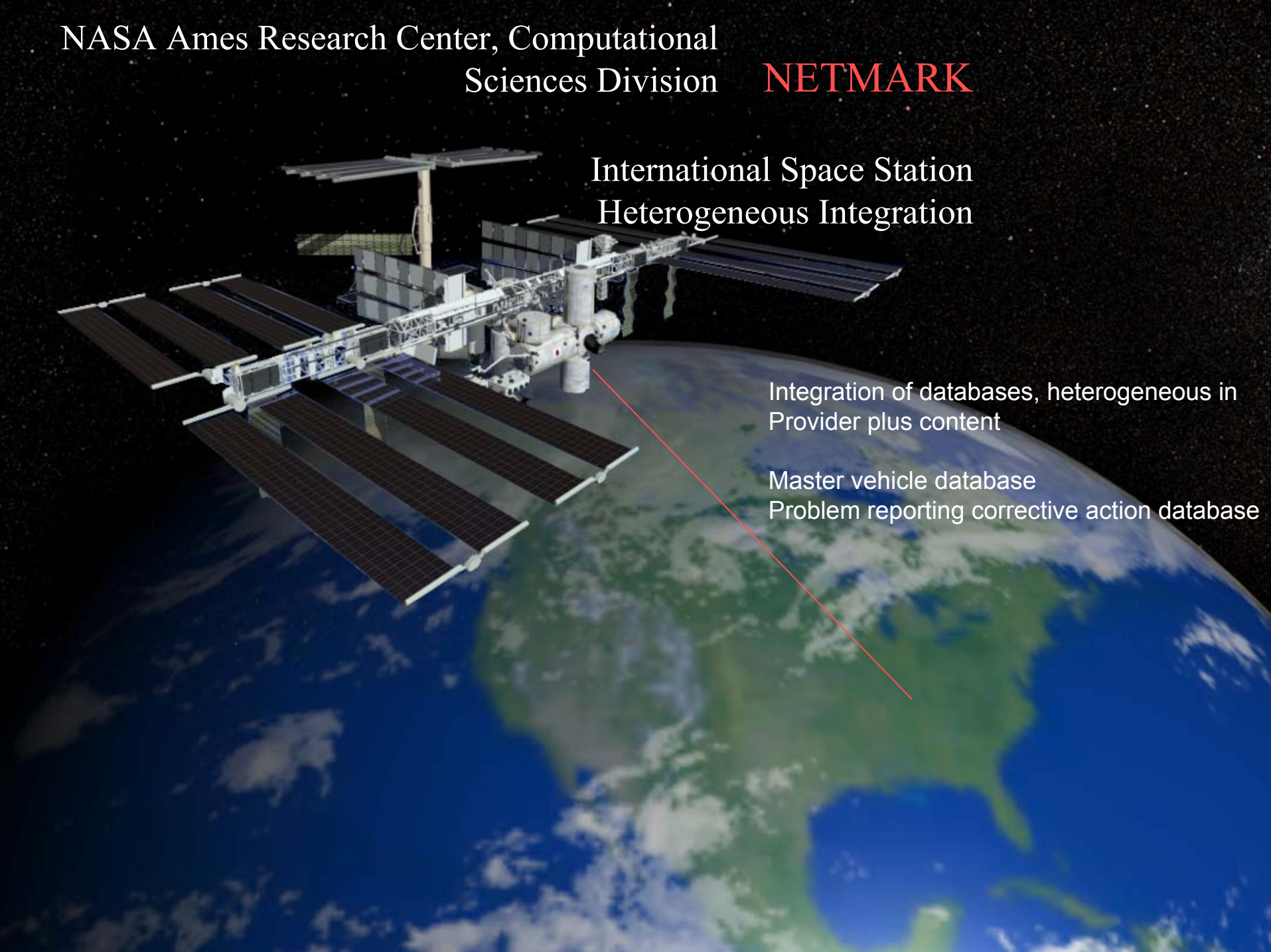
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International Space Station
Heterogeneous Integration

Integration of databases, heterogeneous in
Provider plus content

Master vehicle database
Problem reporting corrective action database



Mars
Altitude: 7,865,889 km
Radius: 3394.000 km
Day length: 24.623 hours
Temperature: 211 K

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2002 10 25 19:44:12 UTC
Real time

Mars Exploration Rover - MER
MER CIP HCC

Meta data capture of Mars 03 mission



Speed: 0.000 m/s

Sync Orbit Mars
FOV: 18 10' 52.0"

Real time integration

```
<XML>
  <source> Master database
    <access_method> RDBMS
  ...
  <source> PRACA
    <access_method> http://ww...

  <preprocess_using>
    <query_template> ..

  <postprocess_using>
    <Transliteration> ...
```

Client query provided
from the (sever)

```
<query_template>
  <form action ..>
    <input ..>
  </form>
```

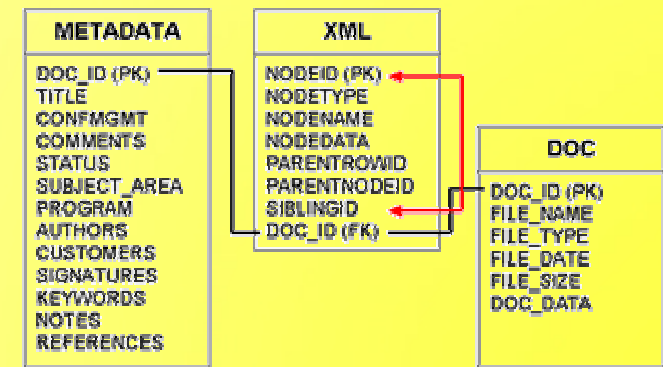


Figure 3: NETMARK Generated Schema

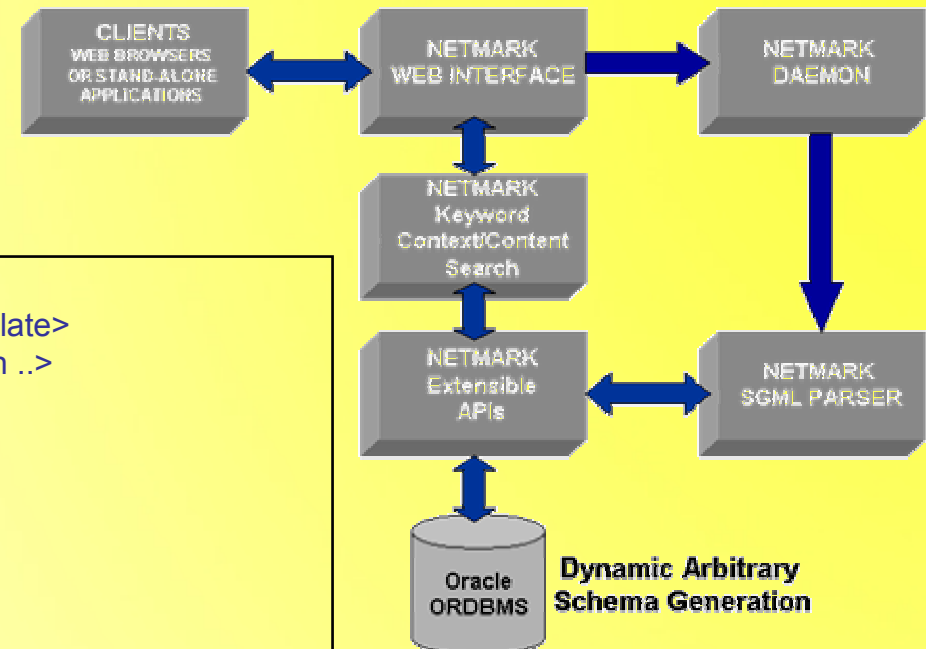
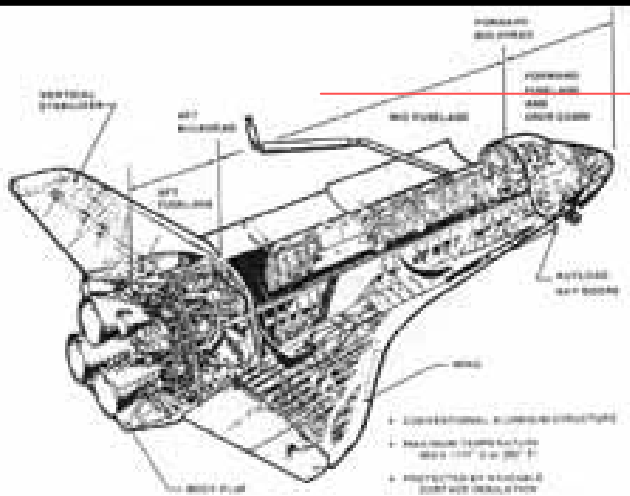


Figure 2: NETMARK Universal Process Flow

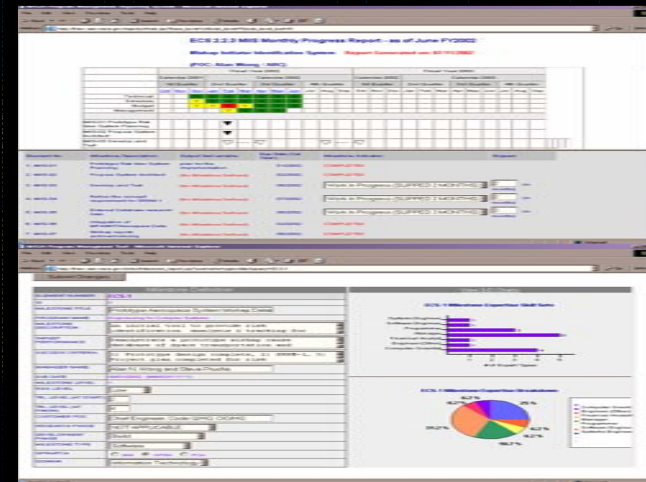
Engineering for Complex Systems



Kennedy space center Digital Shuttle Project knowledge management system for a virtual space shuttle orbiter, including legacy data, engineering data, and 3D graphics models.

Engineering for Complex Systems Program management tool, a WYSIWYG approach (designed as build)

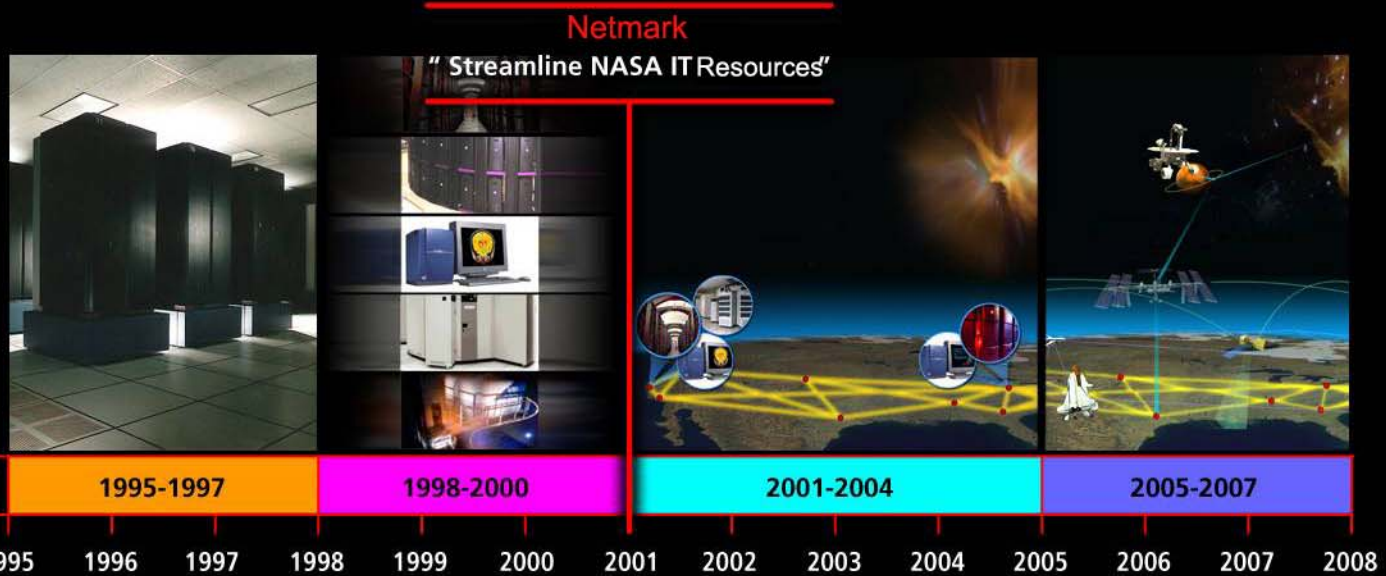
- Zero database intervention



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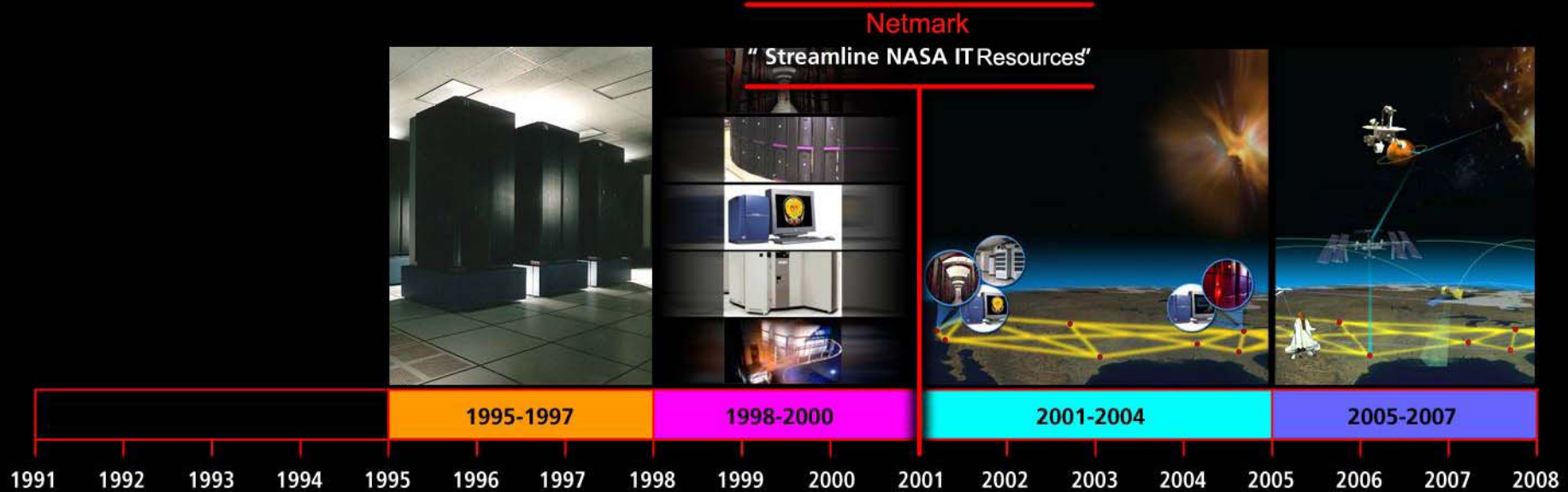
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Understanding the
evolution
of Information



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High Throughput

Faster & Better
Cheaper

Problem space

Problem space is exponential
Solution space has been linear

Solution space

Current Solution Space

NASA investment



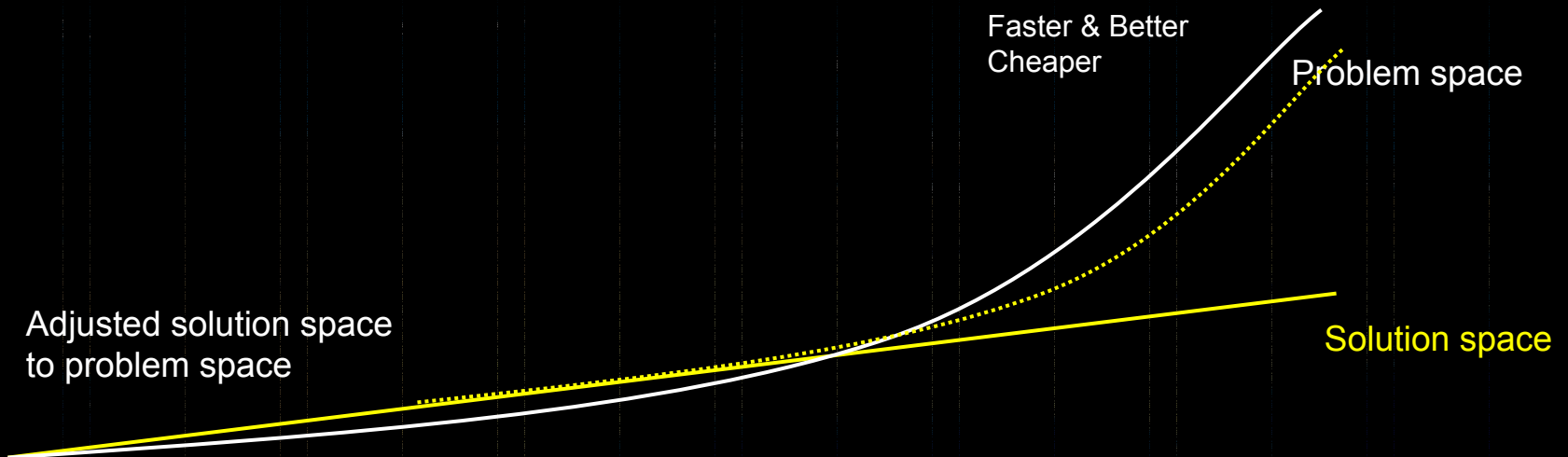
High Throughput

Faster & Better
Cheaper

Problem space

Adjusted solution space
to problem space

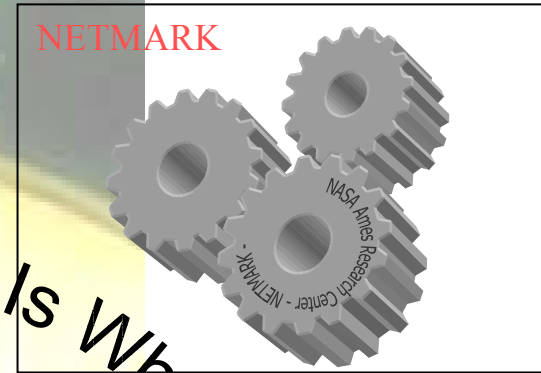
Solution space



What is it to outside NASA

- "Partial Spillovers" for the economics and conditions where third parties derive benefits which they do not pay initially for.
- "Market spillovers" is likely to be an efficiency gain to the new end-users of these technologies.
- "Knowledge spillovers" will happen when firms get cheap access to lessons learned in both technology and successful models.
- "Network spillovers" the synergy, and also having an open source architecture on common problems and expand on related pieces in a coordinated way and according to a condensed time schedule.

What You See Is What You Get



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The future ... 2008